

**$^{12}\text{C}(\text{e},\text{e}')$  1984Hi06,2000Vo04,1975Aj02**

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	J. H. Kelley, J. E. Purcell and C. G. Sheu		NP A968, 71 (2017)	1-Jan-2017

- 1967Af04:  $^{12}\text{C}(\text{e},\text{e})$  E=100,200 MeV, measured  $\sigma(\theta)$ .
- 1967Cr01:  $^{12}\text{C}(\text{e},\text{e}')$  E=100-200 MeV, measured  $\sigma(E(e'),\theta)$ , deduced levels,  $\Gamma_\gamma$ .
- 1968Dr01:  $^{12}\text{C}(\text{e},\text{e}')$  E=140 MeV, measured  $\sigma(E(e'),\theta)$ , measured form factors, deduced giant resonance structure.
- 1968Pr01:  $^{12}\text{C}(\text{e},\text{e}')$  E=100-200 MeV, measured  $\sigma(E(e'),\theta=180^\circ)$ , deduced levels,  $J, \pi, \Gamma_\gamma$ .
- 1968Ri06:  $^{12}\text{C}(\text{e},\text{e}')$  E=60-100 MeV, measured  $\sigma(E(e'),\theta)$ , deduced giant resonance structure.
- 1969Be21:  $^{12}\text{C}(\text{e},\text{e})$  E=30-60 MeV, measured  $\sigma(E,\theta)$ .  $^{12}\text{C}$  deduced charge radii.
- 1969Gu05,1970Gu12:  $^{12}\text{C}(\text{e},\text{e}')$  E=200 MeV, measured  $\sigma(E(e'),\theta)$ , measured form factors, deduced giant resonance structure.
- 1969To01:  $^{12}\text{C}(\text{e},\text{e}')$  E=183,200 MeV, measured  $\sigma(E(e'))$ , measured form factors. Analyzed  $^{12}\text{C}^*(10.84)$ .
- 1969Va10:  $^{12}\text{C}(\text{e},\text{e}')$  E=50,65,70 MeV, measured  $\sigma(E(e'))$ , measured form factors, deduced levels.
- 1970Li02:  $^{12}\text{C}(\text{e},\text{e}')$  E=52-102 MeV, measured  $\sigma(E(e'),\theta)$ , measured form factors, deduced giant resonance structure.
- 1970Si08:  $^{12}\text{C}(\text{e},\text{e})$  E=375,750 MeV, measured  $\sigma(\theta)$ .  $^{12}\text{C}$  deduced charge distributions.
- 1969To10,1970To13:  $^{12}\text{C}(\text{e},\text{e}')$  E=250 MeV, measured  $\sigma(E(e'),\theta)$ , measured form factors, deduced levels, giant resonance,  $J, \pi$ .
- 1971Be25:  $^{12}\text{C}(\text{e},\text{e})$  E=30,60 MeV, measured  $\sigma(\theta)$ .  $^{12}\text{C}$  deduced rms nuclear charge radii.
- 1971Na14:  $^{12}\text{C}(\text{e},\text{e}),(\text{e},\text{e}')$  E=183,250 MeV, measured  $\sigma(\theta), \sigma(E_e',\theta)$ . Deduced form factors.  $^{12}\text{C}$  deduced rms radii, quadrupole moment, deformation parameters.
- 1971St10:  $^{12}\text{C}(\text{e},\text{e}),(\text{e},\text{e}')$  E=1,1.5,2.25,3,4 GeV, measured  $\sigma(E,\theta)$ . Deduced elastic, inelastic from factors.
- 1972Ja10:  $^{12}\text{C}(\text{e},\text{e})$  Q=0.15-0.7 fm $^{-1}$ , measured absolute cross sections.  $^{12}\text{C}$  deduced charge radii.
- 1973Ch16:  $^{12}\text{C}(\text{e},\text{e}')$  E=150 MeV, measured  $\sigma(E(e'),\theta)$ , deduced  $\Gamma(\gamma_0)(15.11)$ .
- 1973Ki12:  $^{12}\text{C}(\text{e},\text{e})$  E=374.6 MeV, measured  $\sigma(E,\theta)$ .
- 1974Ce01:  $^{12}\text{C}(\text{e},\text{e}')$  E=50.5 MeV, measured  $\sigma(E(e'))$ , deduced resonance  $\Gamma(\gamma_0)$ .
- 1974In05:  $^{12}\text{C}(\text{e},\text{e}),(\text{e},\text{e}')$  measured charge form factors. Deduced  $\alpha$ -clusters.
- 1978Fl09:  $^{12}\text{C}(\text{e},\text{e}')$ ; measured form factors, deduced  $^{12}\text{C}^*(4.44)$  convection currents,  $^{12}\text{C}^*(16.1)$  spin magnetization contributions.
- 1978Fr03:  $^{12}\text{C}(\text{e},\text{e}')$  E=32.8-62.2 MeV, measured  $\sigma(E(e'),\theta)$ , deduced resonance  $\Gamma(\gamma_0)(16.11)$ .
- 1978Sh14:  $^{12}\text{C}(\text{e},\text{e}')$  E=140 MeV; measured  $\sigma(E(e'))$ , deduced resonances.
- 1979Ba72:  $^{12}\text{C}(\text{e},\text{e})$  E=27-87 MeV, measured  $\sigma(E,\theta)$ .  $^{12}\text{C}$  deduced rms radius.
- 1979Ha14:  $^{12}\text{C}(\text{e}^-, \text{e}^-), (\text{e}^-, \text{e}^-), (\text{e}^+, \text{e}^+), (\text{e}^+, \text{e}^+)$  E=very high, measured  $\sigma$ .
- 1979Fl08:  $^{12}\text{C}(\text{e},\text{e}')$ ; measured  $\sigma(^{12}\text{C}^*(12.71,15.11))$ , deduced charge dependent isospin-mixing matrix element.
- 1980Ca07:  $^{12}\text{C}(\text{e},\text{e})$  E=25-115 MeV, measured absolute  $\sigma$ .  $^{12}\text{C}$  deduced ground-state charge distribution shape, rms charge radius.
- 1982Re12:  $^{12}\text{C}(\text{e},\text{e})$  E=100-300 MeV, measured absolute  $\sigma(\theta)$ .  $^{12}\text{C}$  deduced rms radius, charge distribution.
- 1983De53:  $^{12}\text{C}(\text{e},\text{e}')$  E=80-330 MeV; measured  $\sigma(E(e'))$ , deduced resonances,  $J, \pi, \Gamma, \Gamma(\gamma_0)$ .
- 1984Hi06:  $^{12}\text{C}(\text{e},\text{e}')$  E=50.7-338 MeV; measured  $\sigma(E(e'))$ , deduced resonances,  $J, \pi, \Gamma$ .
- 1984Ry01:  $^{12}\text{C}(\text{e},\text{e}')$  E=150.6; measured  $\sigma(\theta, E(e'))$ , deduced resonances.
- 1985Pa01:  $^{12}\text{C}(\text{e},\text{e}'\gamma)$  E=66.9 MeV; measured  $^{12}\text{C}^*(4.44 \text{ MeV})$  longitudinal form factor.
- 1986Of01,1986OfZZ:  $^{12}\text{C}(\text{e},\text{e})$  E=238,374.5,419,431,747.2 MeV, measured form factor. Deduced reaction mechanism, deduced dispersive effect induced energy dependence.
- 1987Hi09:  $^{12}\text{C}(\text{e},\text{e}')$  E=80-485 MeV; deduced  $^{12}\text{C}$  levels excitation form factors.
- 1988Ko21:  $^{12}\text{C}(\text{pol. e},\text{e})$  E≈250 MeV, measured asymmetry vs target voltage.
- 1989Ka36:  $^{12}\text{C}(\text{e},\text{e})$  E=238-690 MeV, measured  $\sigma$  At form factor minimum. Deduced higher order processes role.
- 1990So03,1990Ko47,1991So08:  $^{12}\text{C}(\text{pol. e},\text{e})$  E=250 MeV, measured parity violating electroweak asymmetry.
- 1991Br13:  $^{12}\text{C}(\text{e},\text{e})$  E=238-690 MeV, measured  $\sigma$ . Deduced energy dependence causes.
- 1991Of01:  $^{12}\text{C}(\text{e},\text{e})$  E≈240,430 MeV, measured  $\sigma(\theta)$ . Deduced form factor energy dependence features.  $^{12}\text{C}$  deduced rms charge radius.
- 1995Ca14:  $^{12}\text{C}(\text{e},\text{e}')$  E=60 MeV; measured B(E1)(10.84).
- 1995Lu25:  $^{12}\text{C}(\text{e},\text{e}),(\text{e},\text{e}')$  E=62 MeV, measured  $\sigma(\theta)$ .
- 2000Vo04:  $^{12}\text{C}(\text{e},\text{e}')$  E=30-60 MeV; deduced magnetic dipole transition widths, isospin mixing, Coulomb matrix element.
- 2007Ch04:  $^{12}\text{C}(\text{e},\text{e}),(\text{e},\text{e}')$ , analyzed  $\sigma(\theta)$ .  $^{12}\text{C}$  deduced excited state density, related features.
- 2011Vo16:  $^{12}\text{C}(\text{e},\text{e}')$  E=73 MeV; Measured  $E_e, I_e$ ; deduced pair decay width.
- 2010Ch17: XUNDL dataset compiled by TUNL, 2010.

---

**$^{12}\text{C}(\text{e},\text{e}')$     1984Hi06,2000Vo04,1975Aj02 (continued)**

---

$^{12}\text{C}(\text{e},\text{e}')$  E=29-78 MeV, measured reaction products. Deduced transition form factors, charge density, pair decay width of the Hoyle state. The electron beams impinged on a 6.4 mg/cm<sup>2</sup>, 98.9%  $^{12}\text{C}$  target. Scattered electrons were measured at  $69^\circ < \theta < 141^\circ$ . DWBA and PWBA were used to analyze the q (momentum) dependence for the transition, which is related to the transition width.

**$^{12}\text{C}$  Levels**

$\Gamma_{\gamma 0}$ : from (2000Vo04) except where noted.

E(level) <sup>†</sup>	J <sup>π</sup>	Γ	Comments
0.0			<i>Nuclear charge radius</i> from measurements of the elastic scattering form factor. $R_{\text{r.m.s.}} = 2.471$ fm 9 (=2.478 fm with dispersion corrections) (1991Of01). $R_{\text{r.m.s.}} = 2.464$ fm 12 (= 2.468 fm with dispersion corrections) (1982Re12). $R_{\text{r.m.s.}} = 2.472$ fm 15 (1980Ca07).
$4.44 \times 10^3$	$2^+$		This compares with $R_{\text{r.m.s.}} = 2.4829$ fm 19 from muonic X-ray studies (1984Ru12).
$7.65 \times 10^3$	$0^+$		$T=0$
			The radiative width is $\Gamma_\pi = 62.3 \times 10^{-6}$ eV 20 for pair decay (2010Ch17,2011Vo16). See discussion on the earlier value $\Gamma_\pi = 60 \mu\text{eV}$ 4 in (1980Aj01).
$9.64 \times 10^3$	$3^-$		$T=0; \Gamma_{\gamma 0} = 3.1 \times 10^{-4}$ eV 4
$10.84 \times 10^3$	$1^-$		$T=0$
$11.83 \times 10^3$	$2^-$		$T=0$
$12.71 \times 10^3$	$1^+$	$14.6^\ddagger$ eV 26	$T=0; \Gamma_{\gamma 0} = 0.32$ eV 2
$14.08 \times 10^3$	$4^+$	$\approx 0.3$ MeV	$T=0$
$15.11 \times 10^3$	$1^+$		$T=1; \Gamma_{\gamma 0} = 35.9$ eV 6
$15.44 \times 10^3$	4	1.5 MeV 2	
$16.11 \times 10^3$	$2^+$		$T=1; \Gamma_{\gamma 0} = 0.35$ eV 4 $\Gamma_{\gamma 0}$ from (1978Fr03), also see $\Gamma_{\gamma 0} = 0.83$ eV 6 from (1969Gu05).
$16.57 \times 10^3$	$2^-$		$T=1; \Gamma_{\gamma 0} = 48 \times 10^{-3}$ eV 8 $\Gamma_{\text{calculated}} \approx 100$ keV, see (1972An03).
$17.6 \times 10^3$	2		
$18.20 \times 10^3$	5	$(2^-) 0.30^\#$ MeV 10	$T=0$
$18.6 \times 10^3$	1	$(3^-)$	$\Gamma_{\text{calculated}} \approx 300$ keV, see (1972An03).
$19.35 \times 10^3$	10	$2^- 0.40^\#$ MeV 10	$T=1$
$19.59 \times 10^3$	4	$550^\#$ keV 70	$T=1$
$20.0 \times 10^3$	1	$(2^+)$	
$20.56 \times 10^3$	5	$3^+ 300^\#$ keV 50	$T=1$
$21.6 \times 10^3$	1	$(3^-)$	
$22.0 \times 10^3$	1	$(1^-)$	$\Gamma_{\text{calculated}} \approx 2-3$ MeV, see (1972An03).
$22.7 \times 10^3$	1	$(2^-) 0.45^\#$ MeV 15	$T=1$
$23.8 \times 10^3$	1	$(1^-)$	
$24.9 \times 10^3$			
$25.5 \times 10^3$		$(1^-)$	
$25.5 \times 10^3$		$(3^-)$	
$26.4 \times 10^3$	3		
$27.8 \times 10^3$	2		
$30.2 \times 10^3$	4		
$32.3 \times 10^3$	3		

<sup>†</sup> See references in (1975Aj02).

<sup>‡</sup> From (1974Ce01).

<sup>#</sup> From (1984Hi06).